Having described the preferred embodiments, the invention is now claimed to be:

1. A method for shimming a magnetic resonance imaging scanner (10), the method including:

performing at least one of fat suppression and moving blood suppression to suppress magnetic resonance from at least one region of fat and moving blood;

measuring first and second magnetic resonance echoes emanating from a generally columnar volume;

reconstructing the measurements of the first and second magnetic resonance echoes into corresponding first and second generally columnar projection images;

combining the first and second generally columnar projection images to produce a magnetic field profile of the generally columnar volume;

extracting selected magnetic field parameters from the magnetic field profile;

computing shim currents from the selected magnetic field parameters; and

applying the shim currents to magnetic field coils (16, 60).

2. The method as set forth in claim 1, wherein the first and second magnetic resonance echoes include a spin echo and a field echo.

3. The method as set forth in claim 1, further including:

interposing a delay corresponding to a multiple of a fat-water period between the measuring of the first magnetic resonance echo and the measuring of the second magnetic resonance echo.

4. The method as set forth in claim 1, wherein the measuring of first and second magnetic resonance echoes employs a symmetric echo sequence in which echoes are spaced by a selected time interval.

5. The method as set forth in claim 1, wherein the combining of the first and second generally columnar projection images to produce a magnetic field profile includes:

computing a phase difference between the first and second generally columnar projection images to produce a phase-wrapped magnetic field profile; and

phase unwrapping the phase-wrapped magnetic field profile.

6. The method as set forth in claim 5, further including:

identifying at least one usable region that is bounded by unusable regions of low magnetic resonance signal; and

phase unwrapping the at least one usable region.

7. The method as set forth in claim 6, wherein the identifying of at least one usable region that is bounded by regions of low magnetic resonance signal includes:

computing a mean of the phase-wrapped magnetic field profile; and

identifying region boundaries corresponding to mean crossings.

8. The method as set forth in claim 1, wherein the performing of at least one of fat suppression and moving blood suppression includes:

performing a black blood preparation prior to the measuring of the first and second magnetic resonance echoes.

9. The method as set forth in claim 1, wherein the performing of at least one of fat suppression and moving blood suppression includes:

performing a fat saturation preparation.

10. The method as set forth in claim 1, further including:

repeating the performing of at least one of fat suppression and moving blood suppression and the measuring, reconstructing, combining, and extracting for a plurality of spatial orientations of the generally columnar volume, the computing of a shim current being based on the selected magnetic field parameters obtained at the plurality of spatial orientations.

11. The method as set forth in claim 10, wherein the plurality of spatial orientations include at least five spatial orientations, and the extracting selected magnetic field parameters for each spatial orientation includes:

performing a high-order polynomial fit of order greater than or equal to two of the magnetic field profile to obtain second or higher order magnetic field terms.

12. The method as set forth in claim 11, wherein the plurality of spatial orientations include exactly five spatial orientations.

13. The method as set forth in claim 12, wherein the five spatial orientations are selected as one of:

the set of orientations (45°, 36°), (45°, 108°), (45°, 180°), (45°, 252°), (45°, 324°), and

the set of orientations (15°, 180°), (45°, 180°), (75°, 180°), (105°, 180°), (135°, 180°), where within each set each orientation is indicated by spherical coordinates (θ, ϕ).

14. The method as set forth in claim **10**, wherein the plurality of spatial orientations include 2N+1 spatial orientations where N is a highest order shimming correction of the selected magnetic field parameters to be performed, the spherical θ coordinate is computed as:

$$\theta_k = \frac{\pi}{2(1+N_\theta)}(1+2k) \quad , \quad k = 0,1,...(N_\theta - 1)$$

and the spherical ϕ coordinate is computed as:

$$\phi_j = \frac{\pi}{N_\phi}(1+2j) \quad , \quad j = 0,1,...(N_\phi - 1)$$

where N_θ is a number of θ coordinate values, N_ϕ is a number of ϕ coordinate values, the product $N_\theta \cdot N_\phi$ is the number of spatial orientations to be measured, and $N_\phi \geq 2N+1$.

15. The method as set forth in claim **14**, wherein N_θ equals unity.

16. The method as set forth in claim **1**, wherein the measuring of first and second magnetic resonance echoes emanating from a generally columnar volume includes:

selecting the generally columnar volume using two transverse slice-selective pulses.

17. An apparatus for shimming a magnetic resonance imaging scanner **(10)**, the apparatus including:

a selective resonance suppression means **(82, 84, 86, 90, 92)** for performing at least one of suppression of magnetic resonance in fat and suppression of magnetic resonance in moving blood;

a means **(120)** for measuring first and second magnetic resonance echoes emanating from a generally columnar volume;

a means **(150)** for reconstructing the measurements of the first and second magnetic resonance echoes into corresponding first and second generally columnar projection images;

a means **(160, 166, 170)** for combining the first and second generally columnar projection images to produce a magnetic field profile of the generally columnar volume;

a means (174) for extracting selected magnetic field parameters from the magnetic field profile;

a means (180) for computing shim currents from the selected magnetic field parameters; and

a means (32) for applying the shim currents to magnetic field coils (16, 60).

18. The apparatus as set forth in claim 17, wherein the first and second magnetic resonance echoes include a spin echo and a field echo, and the means (120) for measuring interposes a delay between the measuring of the first magnetic resonance echo and the measuring of the second magnetic resonance echo, the delay corresponding to a multiple of an inverse of a fat-water resonance frequency difference.

19. The apparatus as set forth in claim 17, wherein the means (120) for measuring implements a symmetric echo sequence in which echoes are spaced by a selected time interval.

20. The apparatus as set forth in claim 17, wherein the means (160, 166, 170) for combining includes:

a means (160) for computing a phase difference between the first and second generally columnar projection images to produce a phase-wrapped magnetic field profile;

a means (170) for identifying at least one usable region that is bounded by unusable regions of low magnetic resonance signal; and

a means (166) for phase unwrapping at least one usable region.

21. The apparatus as set forth in claim 17, wherein the selective resonance suppression means (82, 84, 86, 90, 92) includes at least one of:

a means (82, 84, 86) for performing a black blood preparation prior to the measuring of the first and second magnetic resonance echoes, and

a means (90, 92) for performing a fat saturation preparation.

22. The apparatus as set forth in claim 17, wherein the means (180) for computing a shim current includes:

a means (140) for iteratively invoking the selective resonance suppression means (82, 84, 86, 90, 92), the means (120) for measuring, the means (150) for reconstructing, the means (160, 166, 170) for combining, and the means (174) for extracting for a plurality of generally columnar volume orientations; and

a means (180) for solving linear equations to compute the shim current based on the selected magnetic field parameters at the plurality of generally columnar volume orientations.

23. The apparatus as set forth in claim 22, wherein each of the plurality of generally columnar volume orientations are gated to a cyclic physiological motion.

24. The apparatus as set forth in claim 23, wherein the selected magnetic field parameters have order of two or lower, a number of orientations equals five, and each orientation has one of:

a spherical θ coordinate equal to 45° in common, and

a spherical ϕ coordinate equal to 180° in common.